

Chapter 4.1 GROUND WATER PROTECTION PROGRAMS

The 1990 Census estimated that 1.4 million Virginians depended on ground as the sole supply for their domestic water. Approximately 8 out of every 10 Virginian's use ground water from public water supplies, private wells or springs for at least part of their daily water supply. While Virginia's ground water is generally of good quality, both the quality and quantity can vary across the five physiographic provinces found in the state.

Ground water programs in Virginia strive to maintain existing high water quality through adopted statutes, regulations, and policies. Advancing ground water protection efforts is the goal of many state programs in numerous state agencies. In late 1986 an interagency committee was formed to stimulate, strengthen, and coordinate ground water protection activities in Virginia. The Ground Water Protection Steering Committee (GWPSC) continues to meet bi-monthly with representation from the following agencies:

Department of Environmental Quality (DEQ)
Department of Health (VDH)
Chesapeake Bay Local Assistance Department (CBLAD)
Department of Mines, Minerals, and Energy (DMME)
Virginia Polytechnic and State University (VPI&SU)
Department of Housing and Community Development (VDH&CD)
Department of Agriculture and Consumer Services (VDACS)
Department of Conservation and Recreation (DCR)
Department of General Services, Division of Consolidated Laboratories (DCLS)
Department of Business Assistance (DBA)
US Geological Survey (USGS)

The following paragraphs briefly describe ground water protection activities at member agencies. Information provided in Tables 4.1-1, 4.1-2, 4.1-3 and 4.1-4 is presented for the Commonwealth as a whole. System upgrades at the VDH prevented manipulation of listed parameters and detections/violations for public water supply data. In addition, budgetary constraints within the Commonwealth prevent coordinated data collection activities designed to characterize ambient ground water quality and changes to that quality over time on a statistically valid statewide basis.

Source Water and Wellhead Protection Efforts

VDH established several committees in 1998 to develop Virginia's Source Water Assessment Program. VDH is working with the USGS and the Virginia Rural Water Association to ensure successful program implementation. VDH, through a Drinking Water State Revolving Loan Fund Set-Aside, contracted with the Virginia Rural Water Association to contact waterworks to educate them on the importance of source water protection and to assist them in understanding and developing a source water protection plan. Seventy-five waterworks were visited.

Building grassroots support for ground water and wellhead protection continue to be priorities of the GWPSC. Accomplishments during this reporting period include the voluntary completion of Biennial Wellhead Protection Reports, assisting Virginia Rural Water Association with outreach and education, and development and distribution of another wellhead protection publication entitled *Implementing Wellhead Protection: Model Components for Local Governments in Virginia*. Future efforts will include cooperating with the Virginia Department of Health on source water protection issues. Funding for GWPSC activities, including wellhead protection, is provided through DEQ's Federal Ground Water Protection Grant.

Table 4.1-1 Public Water Supply Systems and Population Served from Virginia's 1997 Biennial Wellhead Protection Report

Total Number of Public Water Supply (PWS) systems	3,722
Total Number of GW-Dependent PWS Systems	3,387

Total Number of Community Water Supply Systems	1,333
Total Number of GW-Dependent Community Water Supply Systems	1,018
Total Population Relying on Community Water Supply Systems	6,574,305
Total Population Relying on GW-Dependent Community Water Supply Systems	452,571
Total Number of GW-Dependent Non-Transient Non-Community PWS Systems	579
Total Number of GW-Dependent Transient Non-Community PWS Systems	1,790

Ground Water Management Act of 1992

The 1992 session of the Virginia General Assembly adopted the Act and repealed the Ground Water Act of 1973. The Act establishes criteria for the creation of ground water management areas and requires person who withdraw more than 300,000 gallons of ground water per month to obtain permits. The Act requires that previously exempted agricultural ground water withdrawals obtain ground water withdrawal permits. The DEQ adopted regulations to implement the Act effective September 23, 1993 and amended January 1, 1999. This regulation includes specific requirements for agricultural ground water withdrawal permits and requires DEQ to perform technical evaluations of proposed withdrawals.

Storage Tank Compliance Program

The Registration Program tracks ownership and technical information for 14,500 owners of 86,500 USTs and ASTs at 28,000 facilities in the Commonwealth. Each year the Program receives over 2,000 registrations that report new tanks, tank closures, and amendments to existing tank information, such as changes of ownership. DEQ and the public use registration information to determine the identity of persons responsible for pollution prevention measures and cleanup of releases.

The AST Compliance Program regulates AST facilities of 25,000 gallons or greater that store oil. Nearly 1.5 billion gallons of oil are stored in the 2,800 regulated AST facilities across the Commonwealth. Through facility inspections, the Program seeks to ensure that Virginia's AST facilities have measures in place to prevent releases and to respond quickly and effectively when releases occur. Inspectors are able to inspect each AST facility once every five years.

The UST Compliance Program regulates USTs larger than 110 gallons that contain regulated substances, which include most petroleum products. Nearly 350 million gallons of regulated substances are stored in the 33,000 active USTs across the Commonwealth. Through tank inspections, the Program seeks to ensure that USTs in the Commonwealth have measures in place to prevent releases and to have immediate notice of actual releases. Inspectors are able to inspect each UST facility once every 5 years.

Storage Tank Remediation Program

The Remediation Program directs the investigation and cleanup of the petroleum contaminated sites managed by responsible parties. The DEQ ensures that appropriate emergency response, initial abatement measures, site investigation and site remediation are performed by the responsible party. The DEQ also authorizes activities eligible for reimbursement from the Virginia Petroleum Storage Tank Fund.

The DEQ will itself conduct investigation and cleanup of high-priority petroleum contaminated sites in instances where the responsible party is unknown or financially unable to undertake the required work. Through a number of contractors, the DEQ conducts emergency response, initial abatement measures, site investigation and site remediation.

The DEQ also provides immediate, interim, and permanent relief to individuals whose drinking water wells have been rendered unusable by petroleum contamination. Through a DEQ contractor, carbon filtration

units (CFUs) are installed and maintained on contaminated wells until a permanent solution is implemented. Permanent solutions typically include extension of an existing public water supply or installation of a new well free from petroleum contamination.

In the past four years more than 5,000 cleanups have been completed. Significant streamlining has been achieved as the program has gained experience in risk-based decision making and made reductions in administrative burden. Average cleanup time and average cleanup costs per site are among the lowest in the nation.

Waste Permitting Activities

The Resource Conservation and Recovery Act (RCRA) Base Program addresses groundwater quality issues at both permitted and unpermitted land-based units. Information provided in Table 4.1-4 RCRA Corrective Action category is for non-Hazardous and Solid Waste Amendment (HWSA) sites and is divided into two sectors. The term "sites" refers to facilities; most facilities have more than one regulated unit. There are a total of 47 units among the 36 facilities. The "Base Program Correction Action" sites or "Little C" sites are permitted regulated units required to perform corrective action (RUCA) if the ground water concentrations exceed established Ground Water Protection Standards. The second sector is "Unpermitted Land Disposal Facilities (LDF)" where continued operation of the facility is contingent upon removal or decontamination of contaminated media. In instances where the LDF is closed, groundwater monitoring is required to demonstrate that closure performance standards are met. When standards are not met, the site is issued a Post Closure Permit and corrective action is undertaken.

Federal Facilities and Superfund Program

Included in Table 4.1-4 are ground water contamination statistics from the DEQ's Federal Facilities Restoration and Superfund Office. The Federal Facilities Restoration activities include Department of Defense (DOD) installations (Army, Navy, Air Force, Defense Logistics Agency, and Formerly Used Defense Sites) and two NASA installations for a total of 42 installations. Currently 13 Federal Facilities are listed on the National Priority List (NPL) and there are 29 non-NPL sites. Base Realignment and Closure is occurring at seven facilities. Federal funding from the Department of Defense supports the Federal Facilities Restoration program. The Superfund Program, funded with both Federal and State dollars, carries out activities required by law or legal agreements at 21 NPL sites. Three of these sites have now been cleaned up and delisted. Additional activities within this Office include DEQ's Voluntary Remediation Program (VRP) and the Brownfields Program. The Voluntary Remediation Program provides a mechanism for eligible participants to voluntarily clean up properties not mandated for remediation under existing environmental laws. This program serves as a mechanism for cleanup of Brownfields sites. There are currently 135 VRP sites that are either potential candidates for clean up, formally in the program, or have been cleaned up under the program. EPA funding supports the Voluntary Remediation Program. The DEQ's Brownfields Program, supported by EPA, is currently under development. None of these four programs currently collect ground water quality data; they do receive and review data collected by outside sources.

Pesticide Disposal Program

The VDACS, in cooperation with the Virginia Pesticide Control Board, has conducted a highly popular Pesticide Disposal Program since 1990. As of December 31, 2000 more than 409.1 tons of unwanted pesticides have been collected from 1,875 agricultural producers, pesticide dealers and commercial pest control firms. This program served all of Virginia's counties and independent cities by the end of 1998. A new maintenance phase, in which the State was subdivided into four regions, was initiated in 1999 and would be completed by the Fall, 2002. The pesticide disposal program has benefited from a high level of interagency cooperation among the VDACS, DEQ, DCR, DCLS, and Virginia Cooperative Extension. Funding to support this program has been pooled from Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and Clean Water Act (Sections 319 Non Point Source and 106 Ground Water Protection) grants and the Office of Pesticide Services program fees.

Pesticides and Ground Water Management Plan

In response to the EPA Pesticides and Ground Water Strategy, the VDACS submitted a Generic State Management Plan (GSMP) for pesticides and ground water to EPA Region III in 1993 and received EPA concurrence in 1995. The GSMP established a graduated response plan for pesticides detected in ground water, a process for developing pesticide specific management plans (PSMP) should such be required by anticipated federal rule making and a graduated response approach for managing pesticides identified as potential threats to ground water. In 1999, VDACS provided revised cost estimates for implementing specific pesticides in ground water management plans in the Commonwealth to the US EPA.

Pesticides in Ground Water Monitoring Project

In preparation for implementation of PSMPs, the VDACS completed a “pilot” monitoring project in March 1996. A total of 49 shallow bored wells were sampled in eight localities. Samples were analyzed for alachlor, atrazine, cyanazine, metolachlor, simazine and nitrates. At least one pesticide was detected in nine of the wells. One well exceeded the Maximum Contaminant Level (MCL) established under the Safe Drinking Water Act for alachlor (2 ppb) with a detection of 9 ppb. Thirty-four wells had detectable levels of nitrate. Seven wells exceeded the MCL established under the Safe Drinking Water Act of 10 ppm. The highest level of nitrate was 17.2 ppm.

Studies on the Impact of Pesticide Inputs on Plasticulture Operations

In response to allegations that pesticide contaminants in runoff from agricultural fields under plasticulture were causing increased mortality of larval clams grown in aquaculture, the Pesticide Control Board solicited research proposals in 1997 for studies that would: (1) evaluate the fate and transport of pesticides applied to agricultural crops grown under plasticulture and (2) evaluate best management practices that might reduce the impact of pesticide runoff from agricultural fields under plasticulture.

The Pesticide Control Board funded three research projects:

- a laboratory study to evaluate the fate and transport of copper-based pesticides in an estuarine environment using greenhouse-scale marine ecosystem simulators;
- a small field plot study that focused on alternatives that might allow for a reduction in the amount of the traditional pesticide used for the control of fungal and bacterial diseases; and
- a large-scale ecosystem study to assess the acute and chronic impacts on living resources in tidal creeks downstream of plasticulture and evaluate the transport of crop protectants off of selected fields.

All of the research projects were completed by mid-2001. The results indicate that the traditional chlorothalonil and copper-based crop protectants had the potential to cause acute mortality among clams and other estuarine fauna. However, there was no evidence that the presence of plasticulture in the watershed produced long-term, chronic or community-level impacts on estuarine fauna. It was also determined that the traditional crop protectants could be significantly reduced or eliminated through the use of newer, safer crop protectants such as Actigard and Quadris and the use of Tomcast, a disease forecasting program.

Cat Point Creek Watershed-Shallow Ground Water Monitoring

The DCR, in cooperation with the Tidewater Resource Conservation and Development Council, initiated a ground water monitoring study in the Cat Point Creek watershed in December 1995. Land use in the watershed is dominated by “rowcrop” agriculture, grasslands, and forestry. The purpose of this ground water study was to begin a multiple-year process to evaluate the effectiveness of integrated crop management (ICM) in reducing the loading of nitrate and pesticides to the shallow water-table aquifer. ICM incorporates nutrient management and pest management into one plan to be followed by producers. In this study, two producers implemented ICM at three different study sites (sites 1-3) beginning in the spring of 1996. A well cluster, consisting of three wells per cluster, was established in each of the ICM fields and in the control fields. Ground water samples for nutrients were collected twice a month between February and July and on a monthly basis for all other months. Pesticide samples were collected in May and November of 1996. Atrazine was the only pesticide detected in ground water and it was only found in samples collected at the ICM and control fields at site 1 in May 1996. Pesticides were not detected in any of the

November, 1996 samples. Ground water monitoring activities were funded through the DEQ's Federal 106 Ground Water Protection Grant.

Polecat Creek Watershed-Shallow Ground Water Monitoring

The CBLAD initiated ground water monitoring for nitrates as part of the Polecat Creek Watershed project in June 1997. Activities are partially funded by the Clean Water Act, Section 117 Chesapeake Bay program grant funds and partially by the USGS. The ground water study is being conducted by monitoring ground water level and quality in wells screened in the surficial aquifer. The USGS is conducting the ground water monitoring in Caroline County under a cooperative agreement with CBLAD. There are two well transects installed adjacent to agricultural land and forested areas in Coastal and Piedmont hydro-geologic zones and one transect installed within a low-density residential subdivision that uses septic systems for waste treatment. A total of 30 ground water wells are used for monitoring purpose in the project. The water level measurements are done at a six-to-eight weeks interval and water quality samples are collected quarterly during the year in different seasons from all the transect wells. Overall, the USGS is determining water level variations, age-dating, and water chemistry for ground water in this watershed and, ultimately, attempting to learn if pollution is flowing from various types of land uses to surface waters through the ground water systems.

Karst Ground Water Protection Program

The project is implemented by the Natural Areas Management Program in order to document, preserve, and restore the ground water habitats of sensitive species. Project implementation is shared with the Nonpoint Source Management program; an arrangement that highlights the integral connection between the preservation of natural heritage resources and the quality of the State's waters and drinking water supplies. Staff focus on threats to water quality in a 33-county region underlain by cavernous and/or mined-out bedrock in western Virginia, and work in close cooperation with Soil and Water Conservation Districts, the US Geological Survey, and the State's Natural Area Preserves Systems. Karst ground water protection is promoted through a combination of technical assistance, data collection (monitoring, mapping, and tracer testing), and public outreach, which includes brochures, materials, and educational efforts coordinated through Project Underground and Project WET. With regard to ground water issues, the program facilitates coordination between the diverse group of agencies and institutions affecting nonpoint source management in each basin.

As demand and reliance on ground water resources increase in agricultural areas undergoing unprecedented residential growth, state agencies are working to establish a karst ground water monitoring network in the vicinity of unstudied nonpoint sources, such as land application sites and rural subdivisions. In addition, the Karst Ground Water Protection Program is cooperating with the US Forestry Service on a karst resource inventory on USFS owned lands.

Virginia Nonpoint Source Pollution Management Program

Virginia has recently developed an update document for the Nonpoint Source Pollution Management Program. This recently completed plan outlines current NPS ground water protection activities and establishes ground water protection goals for the future.

"Geology of Virginia" educational activities

The Virginia Department of Mines, Minerals, and Energy and Radford University produced an interactive, multimedia CDROM series to assist educators with the Standards of Learning for life sciences. The first CD, an introduction to Virginia geology, was produced in the fall of 1999 with a teacher's guide and was mailed to every high school in the Commonwealth. Since that time, three additional CDs and teachers guides have been produced that focus on the Coastal Plain, Piedmont & Blue Ridge, Valley and Ridge & Appalachian Plateau physiographic provinces. Funding was provided through a private-public partnership with DMME, DEQ, CBLAD, USGS, Virginia Department of Education, Charles W. Barger and Son Construction Company, Inc., Boxley Company, Inc., Carter Machinery Company, Inc., E. Dillon and Company, Kyanite Mining Corporation, Luck Stone Corporation, Martin Marietta Aggregates, Rockydale

Quarries Corporation, Salem Stone Corporation, Tarmac American Inc., Tidewater Quarries Inc., U.S. Silica, Virginia Aggregates Association, and Vulcan Materials Company. The final CD and teachers guide was distributed June 2001.

Virginia Ground Water Festival

The first State sponsored Ground Water Festival was held in September 2000 at Massanetta Springs Conference Center in Harrisonburg, Virginia. 383 sixth grade students from Elkton and Hillyard Middle Schools attended the all day education event focusing on ground water protection. The festival was a success due to the cooperation of a number of agencies and their volunteers. Taking part in the festival were staff from DEQ, DCR, USGS, VDACS, DMME, VDH, Headwaters Soil and Water Conservation District, Rocco Enterprises, Inc., Shenandoah Pure Water 2000 Forum, Conservation Services, Shenandoah Soil and Water Conservation District, Harrisonburg High School, Virginia Ground Water Affiliates, Massanetta Springs Conference Center, Virginia Rural Water Association, Pollution Solutions, Holmans Creek Watershed Committee, and Shenandoah National Park. Funding for the Festival was provided through DEQ's 106 Ground Water Protection Grant from EPA, and a grant from the Perrier Group and National Project W.E.T.

Ground Water Protection Program Conclusion

Ground water programs in Virginia strive to maintain the existing high water quality. The Virginia Ground Water Protection Steering Committee (GWPSC), established in 1986, continues to meet bi-monthly as a vehicle for sharing information, for directing attention to important ground water issues, and for taking the lead on ground water protection initiatives requiring an inter-agency approach. This inter-agency advisory committee is designed to stimulate, strengthen, and coordinate ground water protection activities in the Commonwealth. Ground water protection activities in the Commonwealth are as varied as the funding sources that support them.

Table 4.1- 2 Major Sources of Ground Water Contamination

Contaminant Source	Ten Highest-Priority Sources(/)	Factors Considered in Selecting a Contaminant Source	Contaminants
Agricultural Activities			
Agricultural chemical facilities			
Animal feedlots			
Drainage wells			
Fertilizer applications	/	(F) State GW Protection Strategy	(E)
Irrigation practices			
Pesticide applications	/	(F) State GW Protection Strategy	(A,B)
Storage and Treatment Activities			
Land application	/	(F) State GW Protection Strategy	(E)
Material stockpiles			
Storage tank (above ground)			
Storage tank (underground)	/	(F) State GW Protection Strategy	(D)
Surface impoundments	/	(F) State GW Protection Strategy	(E)
Waste piles			
Disposal Activities			
Landfills	/	(F) State GW Protection Strategy	(M) 40 CFR-App IX
Septic systems	/	(F) State GW Protection Strategy	(J)
Hazardous waste generators			
Hazardous waste sites			
Industrial facilities			
Material transfer operations			
Mining and mine drainage	/	(F) State GW Protection Strategy	(M) Acid Leachate
Pipeline and sewer lines			
Salt water intrusion	/	(F) State GW Protection Strategy	(G)
Urban runoff	/	(F) State GW Protection Strategy	(M) NPS pollutants such as fertilizers & heavy metals
Other sources (please specify)			

A-Inorganic Pesticides H-Metals
 B-Organic Pesticides I-Radionuclides
 C-Halogenated Solvents J-Bacteria
 D-Petroleum Compounds K-Protozoa
 E-Nitrite L-Viruses
 F-Fluoride M-Other
 G-Salinity/Brine

Table 4.1-3 Summary of State Ground Water Protection Programs

Programs or Activities	Check* (/)	Implementation Status	Responsible State Agency
Active SARA Title III Program	/	fully-estab.	DEQ
Ambient ground water monitoring system			
Aquifer vulnerability assessment	/	under devel.	VDCR
Aquifer mapping			
Aquifer characterization			
Comprehensive data management system			
EPA-endorsed Core Comprehensive State Ground Water Protection Program (CSGWPP)			
Ground water discharge permits (VPA)	/	fully-estab.	DEQ
Ground water Best Management Practices			
Ground water legislation (Quantity)	/	fully-estab.	DEQ
Ground water classification			
Ground water quality standards	/	fully-estab.	DEQ
Interagency coordination for ground water protection initiatives	/	fully-estab.	DEQ
Nonpoint source controls	/	cont. efforts	VDCR
Pesticide State Management Plan (Generic)	/	fully estab.	VDACS
Pollution Prevention Program			
Resource Conservation and Recovery Act (RCRA) Primacy	/	fully-estab.	DEQ
Source Water Assessment Program	/	fully-estab.	VDH
State Superfund			EPA primacy
State RCRA Program incorporating more stringent requirements than RCRA Primacy			
State septic system regulations	/	fully-estab.	VDH
Underground storage tank installation requirements	/	fully-estab.	DEQ
Underground Storage Tank Remediation Fund	/	fully-estab.	DEQ
Underground Storage Tank Permit Program	/	fully-estab.	DEQ
Underground injection Control Program			EPA primacy
Well abandonment regulations	/	fully-estab.	VDH
Well Installation regulations	/	fully estab.	VDH

Table 4.1-4 Ground Water Contamination Summary

Aquifer Description Commonwealth of Virginia
 Data Reporting Period 1/96 - 12/00

Source Type	Present in reporting area	Number of sites in area	Number of sites that are listed and/or have confirmed releases	Number with confirmed groundwater contamination	Contaminants	Number of site investigations (optional)	Number of sites that have been stabilized or have had the source removed (optional)	Number of sites with corrective action plans (optional)	Number of Sites with active remediation (optional)	Number of sites with cleanup completed (optional)
NPL		21	21	15	(A) append 9					
CERCLIS (non-NPL)		200+								
DOD/DOE (NPL) _ (NPL)		13	13	8	(B)					
DOD/DOE(nonNPL)		29	29	15						
UST & AST as of DEC 2000		16,902	16,902		petroleum hydrocarbons				2,841	14,061
RCRA Corrective Action	PERMITTED	19 facilities	19	13	40CFR APP IX	19	1	5	7	
	UNPERMITTED Unpermitted_ land_ based on HSWA Corrective Action	17 facilities	12	12	40CFR APP IX	0	0	0	12	
Underground Injection										
State Sites										
Nonpoint Sources										
Other (specify)										

Source Type Abbreviations

NPL - National Priority List
 CERCLIS (non-NPL) - Comprehensive Environmental Response, Compensation, and Liability Information System
 DOE - Department of Energy
 DOD - Department of Defense
 LUST - Leaking Underground Storage Tanks
 RCRA - Resource Conservation and Recovery Act

Contaminant Type

(A) listed and characteristic hazardous waste
 (B) metals, halogenated organics, POL,PCB, Pesticides

Table 4.1-5. Aquifer Monitoring Data

Hydrogeologic Setting ⁽¹⁾ Commonwealth of Virginia

Spatial Description (optional) ⁽²⁾ _____

Map Available (optional) ⁽³⁾ _____

Data Reporting Period ⁽⁴⁾ January 1, 1996 through December 31, 2000

Monitoring Data Type	Total No. of Wells Used in the Assessment ⁽⁵⁾	Parameter Groups	Number of Wells								
			No detections of parameters above MDLs or background levels		Nitrate concentrations range from background levels to less than or equal to 5 mg/l		Nitrate ranges from greater than 5 to less than or equal to 10 mg/l	Parameters are detected at concentrations exceeding the MCLs ⁽¹¹⁾	Number of wells removed from service ⁽¹²⁾	Number of wells requiring special treatment ⁽¹³⁾	Background parameters exceed MCLs ⁽¹⁴⁾
					No detections of parameters other than nitrate above MDLs or background levels and/or located in areas that are sensitive or vulnerable						
			ND ⁽⁶⁾	Number of wells in sensitive or vulnerable areas (optional) ⁽⁷⁾	Nitrate =5mg/l VOC, SOC, and other parameters not detected ⁽⁸⁾	Number of wells in sensitive or vulnerable areas (optional) ⁽⁹⁾	Other parameters are detected at concentrations exceeding the MDL but are less than or equal to the MCLs ⁽¹⁰⁾				
Finished Water Quality Data from Public Water Supply Wells	3,010	VOC	1,658				7	258			
		SOC ⁽¹⁵⁾	26				0	0			
		NO ₃	940		1,366		119	21			
		Other ⁽¹⁶⁾									

Numbers provided by the Virginia Department of Health, Office of Water Programs. Data is given for wells associated with mixed systems (surface and ground water) and ground water based systems. SOC data is limited due to waiver programs and no detections in systems that were monitored. Ambient data, Untreated Water Quality data from PWS, and unregulated well data is not collected or not available.